

**UNITED STATES DEPARTMENT OF COMMERCE****Patent and Trademark Office**

Address: COMMISSIONER OF PATENTS AND TRADEMARKS  
Washington, D.C. 20231

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
-----------------	-------------	----------------------	---------------------

09/405,653 09/24/99 NIE

S 202406

HM22/0919

EXAMINER

LEYDIG VOIT & MAYER LTD  
TWO PRUDENTIAL PLAZA  
SUITE 4900  
1800 NORTH STETSON  
CHICAGO IL 60601-6780

PHAM, M

ART UNIT	PAPER NUMBER
----------	--------------

1641

DATE MAILED:

09/19/00 9

**Please find below and/or attached an Office communication concerning this application or proceeding.**

**Commissioner of Patents and Trademarks**

<b>Office Action Summary</b>	Application No.	Applicant(s)
	09/405,653	NIE ET AL.
Examiner	Art Unit	
Minh-Quan K. Pham	1641	

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

**Status**

- 1) Responsive to communication(s) filed on \_\_\_\_\_.
- 2a) This action is **FINAL**.                            2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) Claim(s) 1-68 is/are pending in the application.
  - 4a) Of the above claim(s) 24-37 and 40-68 is/are withdrawn from consideration.
- 5) Claim(s) \_\_\_\_\_ is/are allowed.
- 6) Claim(s) 1-23, 38 and 39 is/are rejected.
- 7) Claim(s) \_\_\_\_\_ is/are objected to.
- 8) Claims \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on \_\_\_\_\_ is/are objected to by the Examiner.
- 11) The proposed drawing correction filed on \_\_\_\_\_ is: a) approved b) disapproved.
- 12) The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. § 119**

- 13) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
  - a) All b) Some \* c) None of the CERTIFIED copies of the priority documents have been:
    1. received.
    2. received in Application No. (Series Code / Serial Number) \_\_\_\_\_.
    3. received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) Acknowledgement is made of a claim for domestic priority under 35 U.S.C. & 119(e).

**Attachment(s)**

- 15) Notice of References Cited (PTO-892)
- 16) Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 17) Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_.

- 18) Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_.
- 19) Notice of Informal Patent Application (PTO-152)
- 20) Other: \_\_\_\_\_

Application/Control Number: 09/405,653  
Art Unit: 1641

Page 2

**DETAILED ACTION**

***Election/Restrictions***

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-23 and 38-39, drawn to a water-soluble luminescent semiconductor quantum dot and a method of making it, classified in class 430, subclass 60.
- II. Claims 24-37 and 40-51, drawn to a conjugate and a method of making the conjugate, classified in class 536, subclass 24.3.
- III. Claims 52-58, drawn to a method of detecting a protein in a sample, classified in class 435, subclass 6.
- IV. Claims 59-68, drawn to a method of detecting a nucleic acid in a sample, classified in class 435, subclass 6.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are unrelated. Inventions are unrelated if it can be shown that they are not disclosed as capable of use together and they have different modes of operation, different functions, or different effects (MPEP § 806.04, MPEP § 808.01). In the instant case the different inventions have different structures and different functions.

Inventions I is unrelated to inventions III-IV. Inventions are unrelated if it can be shown that they are not disclosed as capable of use together and they have different modes of operation, different functions, or different effects (MPEP § 806.04, MPEP § 808.01). In the instant case the semi-conductor of I could not be used to practice the methods of Inventions III and IV.

Inventions II and III are related as product and process of use. The inventions can be shown to be distinct if either or both of the following can be shown: (1) the process for using the product as claimed can be practiced with another materially different product or (2) the product as claimed can be used in a materially different process of using that product (MPEP § 806.05(h)). In the instant case the conjugate of Invention II can be used to practice the method of Invention IV.

Inventions II and IV are related as product and process of use. The inventions can be shown to be distinct if either or both of the following can be shown: (1) the process for using the product as claimed can be practiced with another materially different product or (2) the product as claimed can be used in a materially different process of using that product (MPEP § 806.05(h)). In the instant case the conjugate of Invention II can be used to practice the method of Invention III.

Inventions III and IV are unrelated. Inventions are unrelated if it can be shown that they are not disclosed as capable of use together and they have different modes of operation, different functions, or different effects (MPEP § 806.04, MPEP § 808.01). In the instant case the different inventions employ different steps achieving different outcomes.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification and their recognized divergent subject matter, restriction for examination purposes as indicated is proper.

During a telephone conversation with Salim Hasan on July 13, 2000, a provisional election was made with traverse to prosecute the invention of Group I, claims 1-23 and 38-39. Affirmation of this election must be made by applicant in replying to this Office action. Claims 24-37 and 40-68 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a petition under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

#### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

Claims 1-6, 9-14, 17-18, 21, and 38-39 are rejected under 35 U.S.C. 102(e) as being anticipated by Weiss et al. (US 5,990,479).

Weiss et al. disclose the use of water soluble quantum dots (semiconductor nanocrystal) as probes for biological application wherein the quantum dot is linked to an affinity molecule (see column 2 lines 18-37; and column 10, lines 52-58). The water soluble quantum dots include nanocrystals from group II-VI semiconductors such as ZnS, MgS, etc.; group III-V semiconductors such as GaAs, InGaAs, etc.; and group IV such as Ge, Si, etc. (see column 5, lines 60-67; column 6, lines 1-16; and column 10, line). The quantum dot emits electromagnetic radiation in the range of 200-2000 nm and has a wavelength band of emission not exceeding 40 nm at full width half maximum (FWHM), and preferably not exceeding about 20 nm at FWHM (see column 5, lines 1-10; and column 6, lines 36-47). The size of the quantum dot ranges from 20 Å to 100 Å and can contain a shell of another semiconductor nanocrystal material such as CdSe (see column 6, lines 17-35). The affinity molecules includes monoclonal antibodies, nucleic acids (monomeric or oligomeric), proteins, polysaccharides, sugars, peptides, drugs, and ligands (see column 6, lines 50-67; and column 7 lines 1-4) and can comprise avidin or streptavidin to detect the presence of biotin (see column 10, lines 15-19). The quantum dot is linked to the affinity molecule by a ligand which contains a hydrophobic region and a hydrophilic region (see column 8, lines 15-48). The hydrophilic region can be silanes, amines, phosphine oxides, thiol, phosphorus oxides, etc. (see column 7, lines 8-67; and column 8, lines 1-59). Weiss et al. also disclose methods of making the quantum dot (see examples 1-2). Therefore, Weiss et al. anticipate the invention as claimed.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Weiss et al. (US 5,990,479) in view of Lawless et al. (1995), *Journal of Physical Chemistry*, 99:10329-10335.

See above for the disclosure of Weiss et al.

Weiss et al., however, do not disclose that the linking agent is a mercaptoacetic acid.

Lawless et al. disclose the linking of a quantum dot, CdS to TiO<sub>2</sub> using mercaptoacetic acids (see abstract; and page 10330, second and third paragraphs).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use mercaptoacetic acids as the linking agent, as taught by Lawless et al.,

in the quantum dot of Weiss et al. because mercaptoacetic acids, especially, mercaptopropionic acid, has the advantage of being able to efficiently control the size of the quantum dot, thus, exhibiting a more uniform emission spectrum (see Lawless et al.: page 10330, second paragraph, last sentence).

Claims 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Weiss et al. (US 5,990,479) in view of Hines et al. (1996), *Journal of Physical Chemistry*, 100(2):468-471.

See above for the disclosure of Weiss et al.

Weiss et al., however, do not disclose that the quantum dot is ZnS-capped CdSe.

Hines et al. disclose ZnS-capped CdSe (see abstract; and Introduction).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use ZnS-capped CdSe, as taught by Hines et al., in the quantum dot of Weiss et al., because ZnS-capped CdSe has the advantage of a strong and stable band-edge luminescence, as taught by Hines et al.

Claims 19-20 and 22-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Weiss et al. (US 5,990,479) in view of Hines et al. (1996), *Journal of Physical Chemistry*, 100(2):468-471 and Lawless et al. (1995), *Journal of Physical Chemistry*, 99:10329-10335.

See above for the disclosure of Weiss et al. in view of Hines et al.

Weiss et al. in view of Hines et al., however, do not disclose that the linking agent is a mercaptoacetic acid.

Lawless et al. disclose the linking of a quantum dot, CdS, to TiO<sub>2</sub> using mercaptoacetic acids (see abstract; and page 10330, second and third paragraphs).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use mercaptoacetic acids as the linking agent, as taught by Lawless et al., in the quantum dot of Weiss et al., as modified by Hines et al., because mercaptoacetic acids, especially, mercaptopropionic acid, has the advantage of being able to efficiently control the size of the quantum dot, thus, exhibiting a more uniform emission spectrum (see Lawless et al.: page 10330, second paragraph, last sentence).

### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Alivisatos et al. (US Pat. 5,751,018 and 5,505,928); Nirmal et al. (1996), *Nature*, 383:802-804; Alivisatos (1996), *J. Phys. Chem.*, 100:13226-13239; Dabbousi et al. (1995), *Applied Physics Letters*, 66(11):1316-1318; Colvin et al. (1994), *Nature*, 370:354-357; Norris et al. (1996), *Physical Review B*, 54(24):16347-16354; Norris et al. (1996), *Physical Review B*, 54(24):16338-16346, Murray et al. (1993), *Journal of the American Chemical Society*, 115(19):5706-5715; Dabbousi et al. (1997), *Journal of Physical Chemistry*, 101:9463-9475; Danek et al. (1996), *Chemistry of Materials*, 8:173-180; Matsumoto et al. (1996), *Journal of Physical Chemistry*, 100(32):13781-13785, are cited to show various quantum dots, their construction, properties, and derivatives thereof.

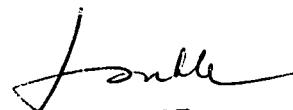
Art Unit: 1641

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Minh-Quan K. Pham, Ph.D., whose telephone number is (703) 305-1444. The examiner can normally be reached on Monday to Friday, 8 AM - 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Long Le can be reached on (703) 305-3399. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-4242 for regular communications and (703) 308-4242 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0196.

Minh-Quan K. Pham, Ph.D.  
September 8, 2000



LONG V. LE  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 1600